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## SEX-HORMONE PRODUCTION IN ADRENAL TUMORS IN CATS

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The adrenal gland consists of two functionally distinct endocrine glands of different embryological origin. The medulla, which is of neuroectodermal origin, comprises approximately ¼ of the adrenal mass and secretes norepinephrine and epinephrine. The surrounding cortex arises from mesoderm and is composed of 3 zones: an outer zona glomerulosa, a zona fasciculata and an inner zona reticularis. The zona fasciculata and reticularis appear to function as a single unit. The zona glomerulosa produces mineralocorticoids (mainly aldosterone) and as it lacks 17 $\alpha$ -hydroxylase activity it cannot produce cortisol or androgens. The zona fasciculata is the thickest layer and produces glucocorticoids (cortisol and corticosterone) and androgens. The zona reticularis produces androgens such as dehydroepiandrosterone (DHEA), its sulfate analog DHEA sulfate and androstenedione as well as glucocorticoids. Those adrenal androgens are converted by peripheral tissues into testosterone and estradiol, whereas conversion within the adrenal cortex is minimal. The physiological role of the adrenal androgens seem to be relatively small. In the absence of gonads, androgen production of the adrenal cortex does not meet physiological requirements. Cortisol and adrenal androgen synthesis is mainly regulated by ACTH, although other factors may also have some effect. Interestingly, cats (and dogs) with pituitary-dependent hypercortisolism do not develop dermal or behavioral symptoms of androgen excess. Their clinical signs are primarily the result of the glucocorticoid excess. The situation is similar in cats with hypercortisolism due to an adrenocortical tumor, e.g. the clinical signs are determined by the major product of the tumor, which is usually cortisol. However, occasionally, adrenocortical tumors may produce other hormones than cortisol. This phenomenon is best characterized in neutered ferrets, in which uni- or bilateral adrenocortical tumors produce sex hormones, mainly androstenedione, 17 $\alpha$  hydroxyprogesterone, DHEA and estradiol rather than cortisol. In cats, sex hormone producing adrenal tumors seems to be rare. Most tumors reported so far were carcinomas, which is similar to human medicine. The majority of tumors were unilateral, however, bilateral tumors have also been described. The exact mechanism for the overproduction of sex-hormones is unclear at the moment, aberrant biosynthetic pathways within the adrenal cortex have been suggested to be a potential cause. The tumors may secrete predominantly one sex hormone, and the clinical picture is dominated by the effect of the particular hormone. However, production of a hormone mixture may also occur.

The following “categories” of sex-hormone producing adrenal tumors have been described:

Excessive progesterone production. The main clinical signs in three cats were polyuria/polydipsia, unkempt hair coat, alopecia (usually truncal), thin skin with increased fragility, abdominal distension. Clinical pathology revealed hyperglycemia consistent with diabetes mellitus. ACTH stimulation test and low-dose dexamethasone test revealed normal or low cortisol concentration. During further work-up, uni-or bilateral adrenal masses as well as increased plasma progesterone concentrations were found. In some of the cats, other precursors or hormones of the steroid biosynthesis pathway were increased additionally.

Excessive progesterone and aldosterone production. Concurrent hyperprogesteronism and hyperaldosteronism has been described in 2 cats. Clinical manifestations were a combination of progesterone excess (see above) and of aldosterone excess; the latter was represented by weakness, hypokalemia, mild azotemia and metabolic alkalosis. Cortisol concentration post ACTH stimulation was low. Diagnosis was based on the findings of high plasma/serum progesterone and high plasma aldosterone concentrations in concert with the ultrasonographic finding of an adrenal mass.

Excessive secretion of estradiol and/or androstenedione and testosterone. One female spayed and one male castrated cat developed male-type behavior, including spraying urine that had a strong “tom-cat” smell, aggressive behavior; the castrated male cat revealed spines on the penis and spayed female cat had hyperplasia of the vulva. Abdominal ultrasonography revealed adrenal masses in both cats. Cortisol concentration post ACTH

stimulation was low. Various precursors of the steroid biosynthesis pathway were increased, the clinical signs were attributed to increased concentrations of androstendione and testosterone. In one cat, adrenalectomy was performed, which resulted in complete resolution of the clinical signs. The other cat showed moderate improvement of clinical signs during treatment with trilostane. One spayed female cat demonstrated cyclic intermittent estrous behaviour and aggression which was attributed to an adrenal tumor secreting increased amounts of estradiol, androstenedione, progesterone and 17 $\alpha$ -hydroxyprogesterone. Clinical signs resolved immediately after adrenalectomy. In summary, sex-hormone producing adrenal tumors are rare events and may pose a diagnostic challenge. Clinical signs of hyperprogesteronism are identical to those of hypercortisolism and a progesterone-producing adrenal tumor should be considered if cortisol concentrations after the administration of ACTH and dexamethasone are low. An estradiol or androstenedione/testosterone producing adrenal tumor may be present in neutered male and female cats with newly developed physical and behavioral sexual changes. Of note, those tumors are usually malignant.

## References

- Boag AK, Neiger R, Church DB. Trilostane treatment of bilateral adrenal enlargement and excessive sex steroid hormone production in a cat. *J Small Anim Pract.* 2004;45:263-266.
- Boord M, Griffin C. Progesterone secreting adrenal mass in a cat with clinical signs of hyperadrenocorticism. *J Am Vet Med Assoc.* 1999;214(5):666-669.
- Briscoe K, Barrs VR, Foster DF, Beatty JA. Hyperaldosteronism and hyperprogesteronism in a cat. *J Feline Med Surg.* 2009;11:758-762.
- DeClue AE, Breshears LA, Pardo ID, Kerl ME, Perlis J, Cohn LA. Hyperaldosteronism and hyperprogesteronism in a cat with adrenal cortical carcinoma. *J Vet Intern Med.* 2005;19:355-358.
- Galac S, Reusch CE, Kooistra HS, Rijnberk A. Adrenals. In: Rijnberk A, Kooistra HS, editors. *Clinical Endocrinology of Dogs and Cats.* 2<sup>nd</sup> ed. Hannover. Schlütersche; 2010.
- Meler EN, Scott-Moncrieff JC, Peter AT, Bennett S, Ramos-Vara J, Salisbury SK, Naughton JF. Cyclic estrous-like behavior in a spayed cat associated with excessive sex-hormone production by an adrenocortical carcinoma. *J Feline Med Surg.* 2011;13:473-478.
- Millard RP, Pickens EH, Wells KL. Excessive production of sex hormones in a cat with adrenocortical tumor. *J Am Vet Med Assoc.* 2009;234(4):505-508.
- Quante S, Sieber-Ruckstuhl N, Wilhelm S, Favrot C, Dennler M, Reusch CE. Hyperprogesteronismus infolge bilateraler Nebennierenrindenkarzinome bei einer Katze mit Diabetes mellitus. *Schweiz Arch Tierheilk.* 2009;151(9):437-442.
- Rossmeisl JH, Scott-Moncrieff JCR, Siems J, Snyder PW, Wells A, Anothayanontha L, Oliver JW. Hyperadrenocorticism and hyperprogesteronemia in a cat with an adrenocortical adenocarcinoma. *J Am Anim Hosp Assoc.* 2000;36:512-517.